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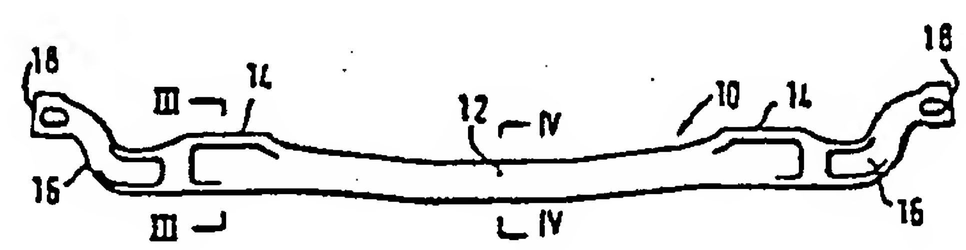
## (54) Method of forging heavy articles.

(57) A heavy goods vehicle front axle beam 10 is produced on a forging press having a rated maximum forging pressure which would normally only enable the press to produce a much lighter weight beam. The method comprises taking an optimally shaped rolled and bent starting blank 10b and subjecting the blank to two consecutive separate pressing operations in the forging press during a first one of which operations the dies of a first toolset act on only part of the blank to forge it to substantially its final shape and act on the remainder of the blank to forge it only to an intermediate shape and in the second of which operations the whole of the part shaped blank is forged to its desired final shape in a second toolset. The pressure exerted during each individual pressing operation is less than the rated maximum forging pressure of the press.

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BT/80.076 Method of Forging Heavy Articles

This invention relates to the production of heavy forged articles such as for example the front axle beams of heavy goods vehicles.

- The nett weight of a heavy goods vehicle front axle beam may typically be in the range of 80 to 110 Kgs. dependent on the size of vehicle whilst the front axle beam of a medium van may be of the order of 20 Kgs. nett weight. Such medium or heavy beams may be, and are conventionally, produced in a drop hammer forge from a steel billet but it is recognised that such drop forging has the disadvantages of poor reproducability of forging pressures, poor tolerances in the final product and the related production of excessive flash.

Press forging can minimise the disadvantages associated with drop forging but a press forge installation is an extremely expensive piece of equipment. Thus although front axle beams can be produced on a press forge installation it is normally necessary to provide an 8,000 tonne press to produce a 20 to 45 Kg. nett weight axle beam whilst to produce a heavy goods vehicle axle beam of the order of 80 to 110 Kgs. nett weight it would be necessary to utilise a 14,000 tonne press.

Conversely it would not be economical to install a 14,000 tonne press unless it was being utilised to its full potential in the production of heavy goods vehicle axle beams. In other words, it would not be economical to use such a press if a range of weights of axle beam was desired to be produced for example from 20 Kgs. to 110 Kgs.

It is an object of the present invention to provide a method of press forging which will enable a press forge to be utilised in the production of heavy products for example 80 to

110 Kgs. on a press having a rated maximum forging pressure normally intended for the production of medium weight products for example of the order of 20 to 45 Kgs.

In accordance with the invention there is provided a method of forging a steel article in a press forge wherein the forging pressure which would be necessary to deform the metal from a starting blank to the desired final shape in a single toolset of the press is greater than the rated maximum forging pressure of the press comprising the steps of taking a starting blank which has been partially shaped, subjecting the blank to a first pressing operation between closed dies of a first toolset wherein the dies act on only part of the blank to forge it to substantially its final shape and act on the remainder of the blank to forge it only to an intermediate shape and then subjecting the part-shaped blank to a second pressing operation between closed dies of a second toolset wherein the dies act on the substantially final shaped parts of the blank and the intermediate shaped parts of the blank to forge the blank to its desired final shape; the pressure exerted during each individual pressing operation being less than said rated maximum forging pressure of the press.

The starting blank is conveniently partially shaped from a billet by rolling and then by bending to the shape in which it is receivable in the first toolset of the press.

Conveniently the article to be forged comprises an axle beam having, in its desired final shape, a centre section, a pair of spring pads, a pair of arms and a pair of king pin bosses; each of said pads, arms and bosses being positioned at each end of said centre section; the pressing steps comprising forging the pads, arms and bosses to substantially their final shape whilst forging the centre section to an intermediate shape in said first toolset and then forging the

whole of the axle beam to its desired final shape in said second toolset.

Thus, by use of the method of forging in accordance with the invention, a forging press having a certain rated maximum forging pressure may be utilised not only for the production of a weight of article for which the press is designed but also for the production of weights of articles which would normally be above those capable of being produced on such a press. In particular, the invention permits, for example, an 8000 tonne forging press to be utilised for the production of a range of articles such as vehicle front axle beams through the 20 Kg. nett weight up to 110 Kgs.

Other features of the invention will become apparent from the following description given herein solely by way of example with reference to the accompanying drawings wherein

Figure 1 is a side view of a typical heavy goods vehicle front axle beam within a nett weight range of 80 Kgs. to 110 Kgs.

Figure 2 is a plan view of the axle beam of Figure 1

Figure 3 is a transverse cross-sectional view on the line III-III of Figure 1.

Figure 4 is a transverse cross-sectional view on the line IV - IV of Figure 1.

Figure 5 is a side view of a rolled steel billet optimised to a preliminary starting blank shape.

Figure 6 is a side view of the starting blank after it has been bent to a shape in which it is receivable in a first toolset of the forging press.

Figure 7 is a transverse cross-sectional view on the line VII - VII of Figure 6.

Figure 8 is a top perspective view of the bottom die of the first toolset of the forging press within which the starting blank of Figure 6 is receivable prior to the first pressing operation and

Figure 9 is a top perspective view of the bottom die of the second toolset within which the part shaped blank produced in the first toolset is receivable prior to the second pressing operation.

The example of the use of the invention as described herein is with respect to the production of a heavy goods vehicle front axle beam, typically within a nett weight range of 80 Kgs. to 110 Kgs. on a forging press having a rated maximum forging pressure typically of 8000 tonnes and which is nominally designed for the production of press forged axle beams not exceeding 20 to 45 Kgs. nett weight. The 80 Kg. to 110 Kgs. axle beam 10 is to be produced to the configuration illustrated in Figures 1 to 4 of the drawings having a maximum overall length of approximately 1800 mms. and a maximum overall depth approximating 100 mms. The shape of the axle beam 10 is of course quite conventional and comprises a centre section 12 having, disposed at each end thereof, a spring pad 14, an arm 16 and a king pin boss 18.

To produce such a heavy axle beam on a forging press in accordance with the invention, an appropriately sized steel billet is first rolled to the preliminary starting blank shape 10a illustrated in Figure 5. The amount of metal deformation occuring during the rolling operation is optimised to relate to the forging pressures necessary to be utilised in the forging press during the final shaping operations and, as will be seen from Figure 5, the rolling operation produces the preliminarily shaped blank 10a wherein

more metal is present at those respective areas of the blank which are to be forged into the pads, arms and bosses than is present in the centre section.

This preliminary starting blank 10a is then introduced to the forging press and bent under a relatively light pressure to the starting blank shape 10b illustrated in Figures 6 and 7 of the drawings. As will be seen from Figures 6 and 7, the metal is deformed during the bending operation to define the basic shaping of the spring pad, arm and king pin boss areas and this shape is such as to enable this starting blank to be receivable within the dies of the first toolset proper of the press.

The bottom die 20 of the first toolset is illustrated in Figure 8, the upper die being similarly and correspondingly shaped, and this toolset configuration is such as to enable substantially the final shape of the pads, arms and bosses to be forged during a first pressing operation whilst the centre section is forged only to an intermediate shape. Typically the metal deformation from the starting blank shape 10b to the part-shaped blank produced after the first pressing operation in the first toolset is achievable utilising a maximum of 85% of the rated maximum forging pressure of the press. The part-shaped blank is then transferred to the second toolset, whose bottom die 22 is illustrated in Figure 9 of the drawings, and a second pressing operation is carried out to shape the spring pads 14 and the centre section 12 to their final shape whilst the flash gap in the areas which have been fully formed, i.e. the king pin bosses 18 and the arms 16, is increased in the second toolset to reduce to a minimum any additional pressure whilst the spring pads 14 and the centre section 12 are being fully formed; the forging pressure utilised during this second pressing operation also being less than the rated maximum forging pressure of the press.

It will be appreciated that the actual forging pressures in both of the individual pressing operations of the process are carefully optimised to minimise the production of flash. Such optimisation together with that of the roll design by which the preliminary shaped starting blank is produced enables a reduction in the gross forging weight to be achieved.

CLAIMS

1. A method of forging a steel article in a forging press which has a rated maximum forging pressure characterised in that the forging pressure which would be necessary to deform the metal from a starting blank to the desired final shape in a single toolset of the press is greater than the rated maximum forging pressure of the press and in that the forging process comprises the steps of taking a starting blank which has been partially shaped, subjecting the blank to a first pressing operation between closed dies of a first toolset wherein the dies act on only a part of the blank to forge it to subtantially its final shape and act on the remainder of the blank to forge it only to an intermediate shape and then subjecting the part-shaped blank to a second pressing operation between closed dies of a second toolset wherein the dies act on the substantially final shaped parts of the blank and the intermediate shaped parts of the blank to forge the blank to its desired final shape; the pressure exerted during each individual pressing operation being less than said rated maxiumum forging pressure of the press.

2. A method according to Claim 1 further characterised in that the starting blank is partially shaped from a billet by rolling and then by bending to a shape in which it is receivable in the first toolset of the press.

3. A method according to either one of Claims 1 or 2 further characterised in that the article to be forged comprises an axle beam having in its desired final shape, a centre section a pair of spring pads, a pair of arms and a pair of king pin bosses; each of said pads, arms and bosses being positioned at each end of said centre section; the pressing steps comprising forging the pads, arms and bosses to substantially their final shape whilst forging the centre section to an intermediate shape in said first toolset and then forging the whole of the axle beam to its desired final shape in said second toolset.

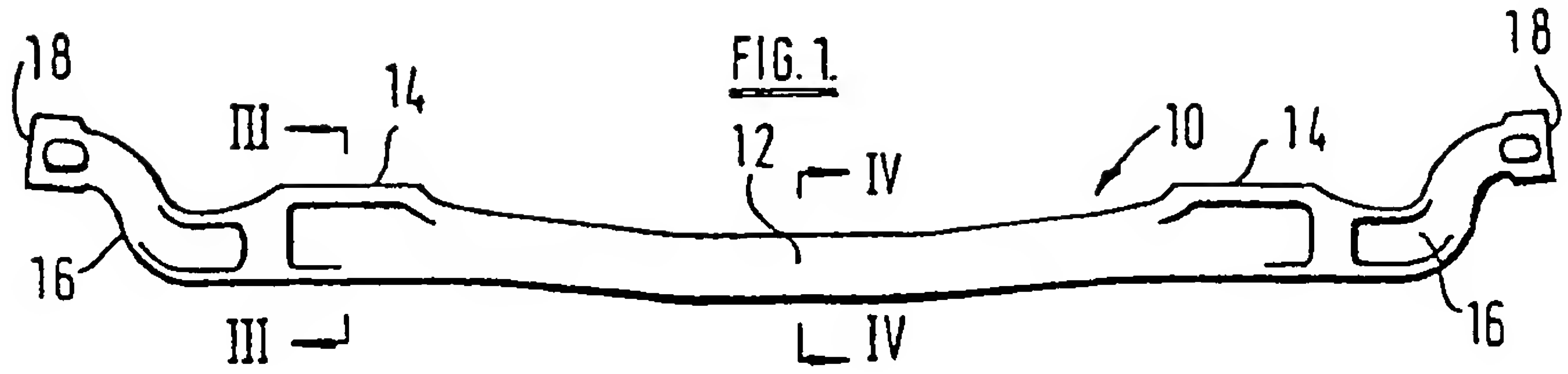


FIG. 1.

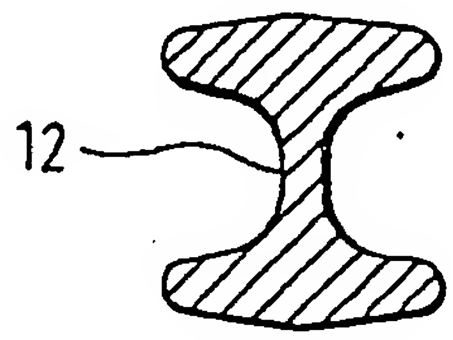


FIG. 4.

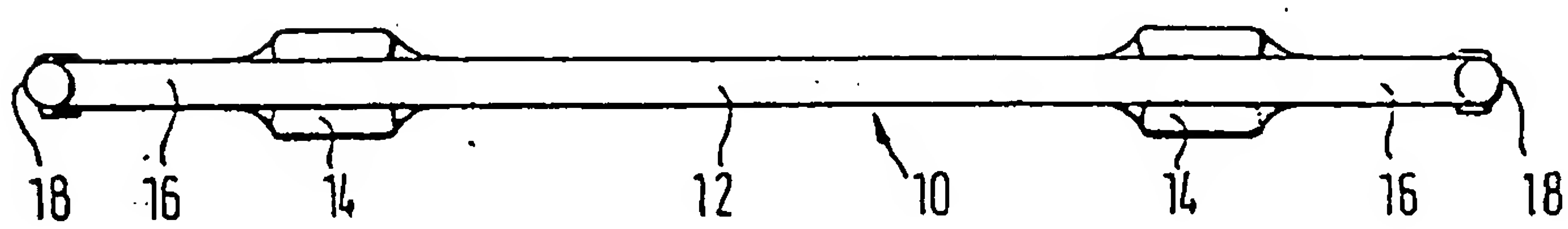


FIG. 2.

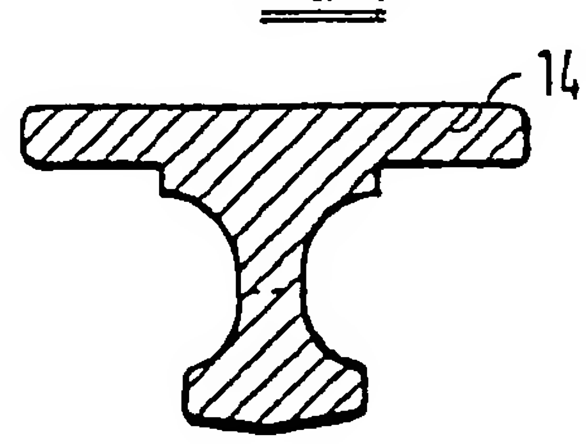


FIG. 3.

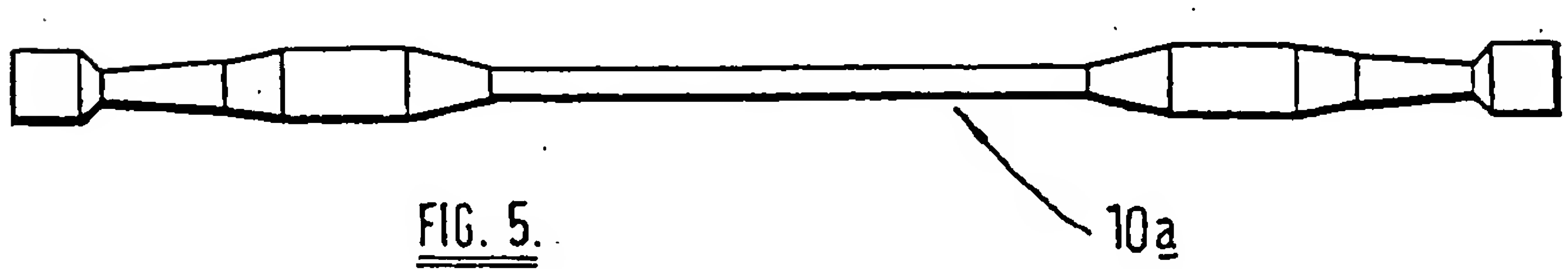


FIG. 5.

FIG. 7.

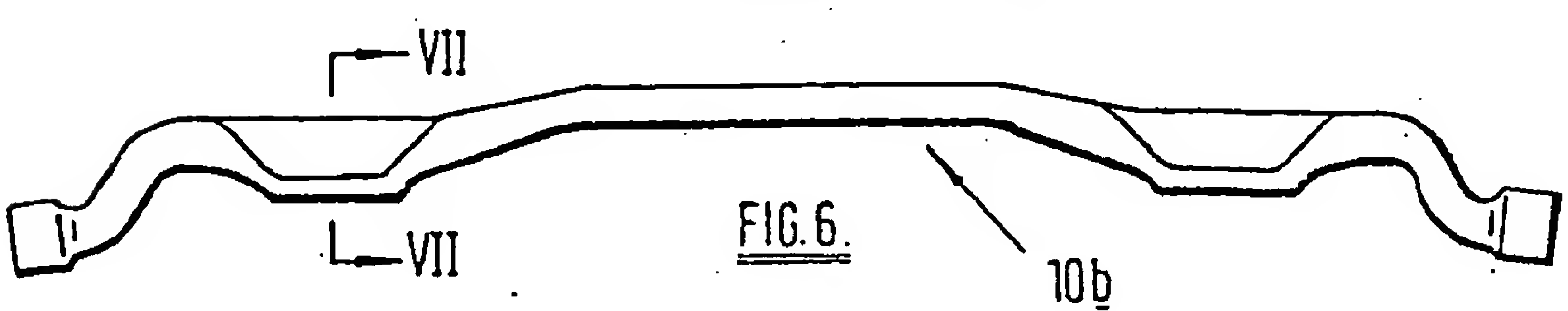


FIG. 6.

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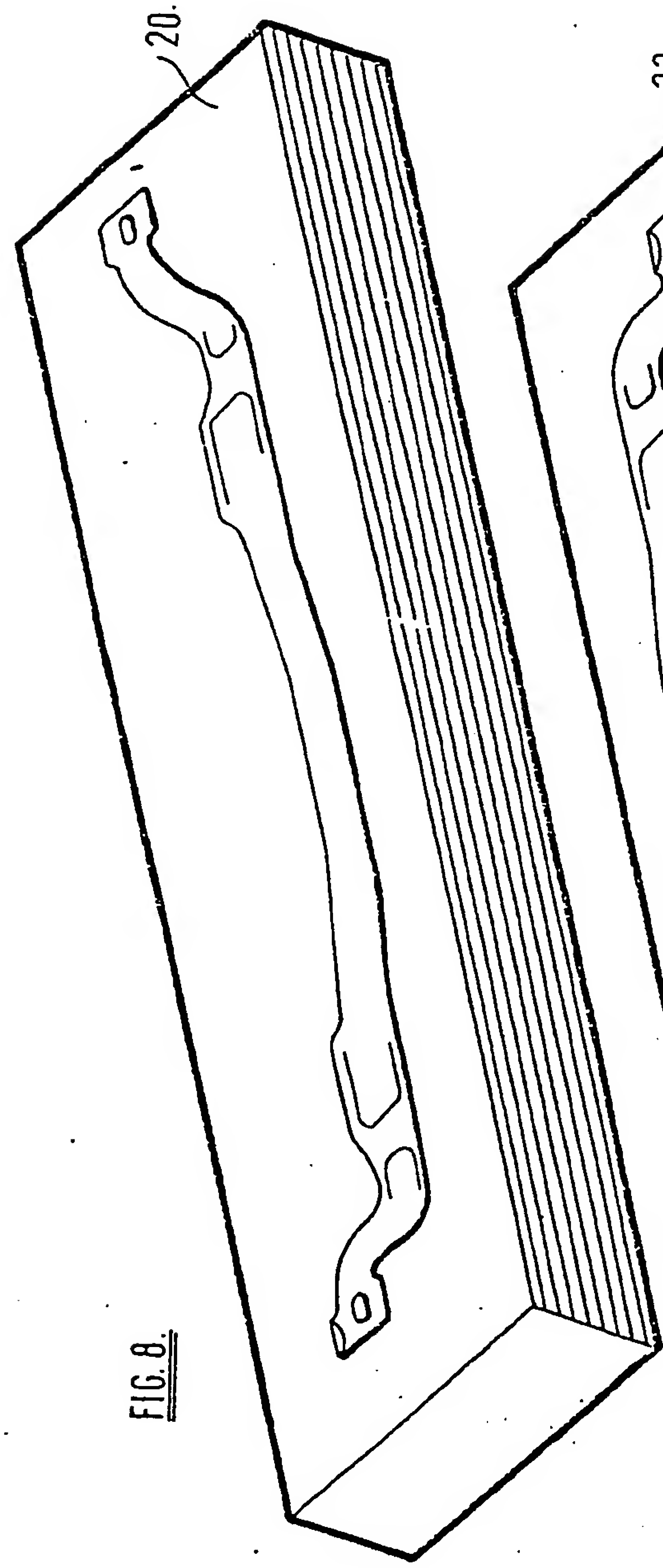


FIG. 8.

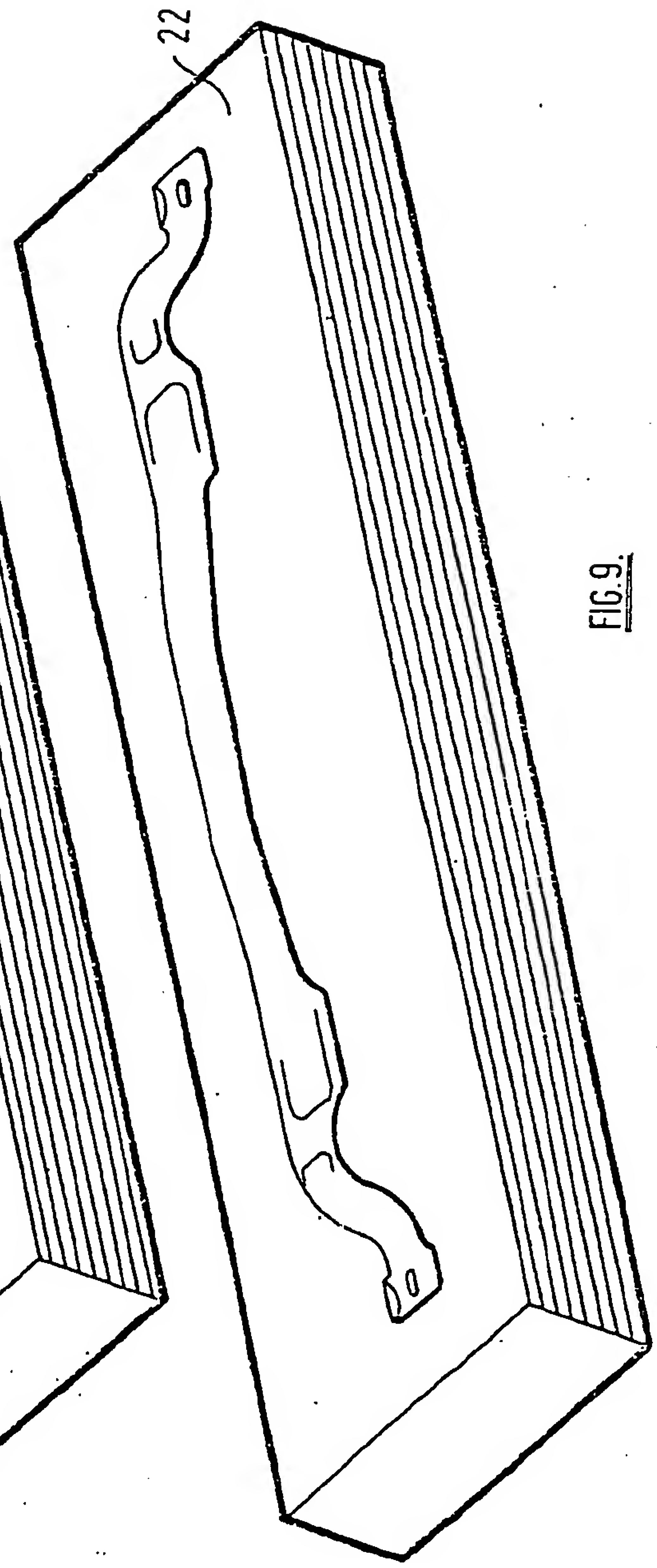


FIG. 9.